Unsteady Flow and Control in Butterfly Take-off Flight of Fluid Dynamics Videos

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Abstract

In this work, high-resolution, high-speed videos of a Monarch butterfly (Danaus plexippus) in take-off flight were obtained using a photogrammetry system. Using a 3D subdivision surface reconstruction methodology, the butterfly's body/wing deformation and kinematics were modeled and reconstructed from those videos. High fidelity simulations were then carried out in order to understand vortex formation in both near-field and far-field of butterfly wings and examine the associated aerodynamic performance. A Cartesian grid based sharp interface immersed boundary solver was used to handle such flows in all their complexity.